XIV. MICROWAVE THERMOGRAPHY

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1. MICROWAVE THERMOGRAPHY

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We have continued to develop and evaluate microwave radiometers for clinical detection of breast cancer. In collaboration with Dr. N. L. Sadowsky of Faulkner Hospital we have examined over 70 women with breast cancer confirmed by biopsy and over 4000 normal women, using a 3.3 GHz radiometer. We also examined over 25 women with breast cancer and over 1000 normal women, using a 1.3 GHz radiometer. A simple quantitative criterion of detection relies mainly on temperature asymmetry between the right and left breasts. With this criterion, observation at each frequency gives detection of about 70% of the cancers and a "false alarm" rate of about 30%. Each of these rates is similar to the corresponding detection rate of infrared thermography on the same set of patients. When the 3-GHz and infrared data are combined, the resulting cancer detection rate exceeds 90%. If microwave and infrared examinations are used as a zero-risk first-pass screen, and if mammography is used only as a follow-up of positive cases, then the resulting detection rate is about 90% and the false alarm rate can be about 15%. These results are the same as those of a program of mammography screening alone, but the number of women exposed to x rays is reduced by more than half. Thus the combined use of safe methods such as microwave and infrared examinations for breast cancer screening appears to be a distinct possibility.

Our equipment development and testing work has continued. We have completed 6-GHz tissue-matched antennas, a 6-GHz low-noise radiometer, and a microprocessor-based data handler, and expect to begin clinical evaluation of this system in the next year. We have also developed and tested higher resolution antennas. We now have two methods to evaluate the sensitivity-resolution tradeoffs involved in use of new antennas: one based on diode scattering of radiated power, and one based on the use of artificial thermal sources embedded in phantom tissue models.